COMPOUND STOOL WITH ENERGY STORING SPRING

Be it known that I, Richard D. Knowles, a citizen of the United States and a resident of the City of Spokane in Spokane County and the State of Washington, whose post office address is 1743 North Regal Street, Spokane, Washington 99207, have invented certain new and useful improvements in COMPOUND STOOL WITH ENERGY STORING SPRING of which the following is a specification for which I pray the issuance of Letters Patent.

II. BACKGROUND OF INVENTION

IIA. RELATED APPLICATIONS

There are no applications related hereto heretofore filed in this or any foreign country.

IIB. FIELD OF INVENTION

My invention relates generally to chairs or seats and more particularly to a compound stool having a compression spring between a base and a relatively movable seat structure which may move vertically to aid a user's ingress on and exit from the stool.

IIC. BACKGROUND AND DESCRIPTION OF PRIOR ART

Stools have long been used for support of a seated user and, though their developmental period has been long and the state of their development has become sophisticated, there still remain unsolved problems with present day stools. The instant stool solves some of those remaining problems by providing a relatively low seat structure that moves vertically to allow a seated user to easily work on a surface supporting the stool, while yet providing auxiliary supports and associated spring structure to store energy generated by a seated user to aid the user in entering, using and exiting the stool.

The height of seating surfaces for supporting an average user in a seated posture varies widely from

about 4 or 5 inches to more than 40 inches above a supporting surface, the latter of which height may require an auxiliary step or some similar device to allow a user to enter on the seating surface. The average height of ordinary seat support surfaces is approximately 18 to 20 inches above a supporting surface, but it often is difficult for some users of seating devices to gain a seated position even on such seat support surfaces. This difficulty tends to increase in proportion to the distance that the seat support surface varies from the average seat support height and is enhanced by any physical decrepitude that the user may have, such as from age or infirmities.

A seat support for a person working on or at the level of the surface supporting the seat support must of necessity provide a support surface at a relatively low height, usually about 12 to 14 inches or less, to allow a seated person to conveniently access the seat supporting surface. This is particularly true for persons working on or near a floor or gardeners working in the surface of the earth. Such lower seating devices provide particular problems and challenges for a disabled or infirm user as they are particularly difficult to both enter and exit. The instant device provides a stool type support that has a vertically movable seat structure that may be entered at a raised position to subsequently move downwardly responsive to the user's weight by reason of bias created in a

supporting compression spring beneath the seat structure which stores the energy creating its bias to subsequently release that energy when the user gets up from the stool to aid the user's exiting motion.

The difficultly in entering, using and exiting relatively low seating devices has heretofore been recognized and responsively various solutions have been proposed, including the use of compound seating devices having a seat structure that is at least somewhat vertically movable relative to a supporting base with associated spring structure that is affected by vertical motion of the seat structure in some fashion. Several devices incorporating such structures have been associated with seats in vehicles or other moving support mechanisms to act as shock absorbers to lessen vertical inertial motion of a seat carrying a user responsive to rapid change in vertically orientated motion of the vehicle or other support mechanism carrying the seat. These shock absorbing devices distribute inertial forces over both a greater distance and a greater period of time than would result without the shock absorbing device, to both physically and psychologically lessen the effects, or at least the perceived effects, of shocks. Most such shock absorbing seat structures have relatively strong springs that allow only slight spring motion responsive to relatively large impressed forces to effectively accomplish their purposes. The instant invention is distinguished and

teaches away from this type of shock absorbing seat in that the instant invention provides substantially greater linear motion of the spring supporting the seat support responsive to a similar force to allow the seat to move a substantially greater distance from its null position than would a shock absorber. The kinetic energy created by such spring motion is stored in the spring to allow that energy to be released as the seated user exits from the seat support to aid that exiting motion.

Various other devices have moved a seat supported for vertical motion either by motor powered mechanisms or indirect action of spring mechanisms to aid entry, exit or both to and from the seat.

Such devices that are motorized are distinguishable from the instant stool by reason of its use only of a simple compression spring to accomplish its purposes. The motorized devices generally have been concerned with regulation of the height of the seat to an adjustable position where, after adjustment, the seat remains until again moved by its powering mechanism. In contradistinction the instant seat support moves automatically each time a user enters, exits or changes the amount of his weight supported on the seat support.

Such devices that have used springs to aid entry or exit from a seat generally provide a compound structure including levers, bell cranks and the like to accomplish their purpose, whereas the instant mechanism uses merely

a simple compression spring which is more reliable and durable with no parts that move relatively to wear or require maintenance by reason of their movable engagement. The instant seat support has relatively linear motion substantially directly proportionate to the applied force through its operative range, whereas compound spring structures generally provide seat motion that is not directly proportionate to applied force. The instant spring in contradistinction from prior devices provides adjustment to allow convenient use by persons of differing weights by adjustment of the tension in the seat supporting spring when the seat support is in a null position. To accomplish this function the spring is contained in a chamber between a top and a bottom spring support that is adjustably movable toward and away from the top to regulate biasing force in the spring when in a null position extended between the top and spring bottom support.

The structure of prior spring moved seats to aid entry and exit often has provided a forward tilting motion of the seat while moving upwardly. The instant seat in contradistinction moves the seat support vertically upwardly, with very little if any tilting motion in any direction, to make the motion safer and more adaptable for use by persons lacking agility and balance to accommodate to tilting seat motion.

The instant stool also provides associated ancillary support structure for a user to aid in

maintaining balance, aid entering and exiting the seat structure and aid in determining user position prior to and after entering and exiting the seat structure, all in distinguishment from prior spring operated seating devices that in general have not provided such ancillary support structure.

My invention lies not in any one of these features individually, but rather in the synergistic combination of all of its structures that give rise to the functions necessarily flowing therefrom.

III. SUMMARY OF INVENTION

My stool provides a peripherally defined truncated conic base defining an internal chamber and carrying plural depending support wheels and external upstanding user support structure. The internal chamber carries a bottom spring support plate for adjustable vertical positioning above the chamber bottom with a compression spring supported between the bottom spring support and an upper spring disk biased against the under surface of the truncated top of the base. Seat support structure positioned spacedly above the base provides plural depending support rods movably communicating through the base top to the upper spring disk therebeneath to move the upper spring disk responsive to vertical motion of the seat, which responsively vertically moves the compression spring. Fastening mechanism carried by the base top releaseably fastens the seat support structure

in a lowermost position, spacedly above the truncated top of the base.

In creating such device, it is:

A principal object to provide a stool having a base supporting a seat support structure extending spacedly thereabove for vertical motion biased to an upwardmost null position.

A further object is to provide such a stool having a base defining an internal chamber carrying a compression spring which moves vertically responsive to vertical motion of the seat structure to store kinetic energy that is releasable on upward motion of the seat to aid a user in exiting from the stool.

A further object is to provide such a stool having a compression spring that moves downwardly responsive to a user's weight on the seat to allow a user to enter the seat at a higher position and move the seat downwardly by his weight to be ultimately supported below the entry level to allow easier user access to an underlying surface supporting the stool.

A further object is to provide such a stool with at least three wheels supporting the base for motion on a supporting surface when not supporting a user and for positional maintenance on the supporting surface when supporting the user.

A still further object is to provide such a stool with similar paired laterally opposed upstanding side supports to aid a user in entering on and exiting from

the seat support.

A still further object is to provide such a stool that has latch mechanism to releasably maintain the seat support in a lowermost position, spacedly above the truncated top of the base.

A still further object is to provide such a stool that is of new and novel design, of rugged and durable nature, of simple and economic manufacture and one otherwise well-suited to the uses and purposes for which it is intended.

Other and further objects of my invention will appear from the following specification and accompanying drawings which form a part hereof. In carrying out the objects of my invention however, it is to be understood that its essential features are susceptible of change in design and structural arrangement with only one preferred and practical embodiment of the best known mode being illustrated in the accompanying drawings and specification as is required.

IV. BRIEF DESCRIPTION OF DRAWINGS

In the accompanying drawings which form a part hereof and wherein like numbers of reference refer to similar parts throughout:

Figure 1 is an isometric rearwardly looking view of my stool showing various of its parts, their configuration and relationship.

Figure 2 is an isometric forwardly looking view of the stool to further show its parts, their configuration and relationship from this aspect.

Figure 3 is a slightly enlarged vertical cross-sectional view through the stool of Figure 2, taken on the line 3-3 thereon in the direction indicated by the arrows, to show internal structure with the fastening mechanism in unfastened position and the external support structure cut away for clarity.

Figure 4 is a view similar to that of Figure 3 taken on the cross-sectional line 3-3 and in the direction indicated by the arrows thereon, but showing the fastening mechanism in fastened position.

Figure 5 is an isometric view of the fastening lever of the fastening mechanism, isolated from the stool to show its configuration.

Figure 6 is an orthographic top view of the base bottom and associated spring bottom support isolated from the other stool structure to show the adjustable interconnection of the isolated structures.

Figure 7 is a medial vertical cross-sectional view

through the structure of Figure 6 taken on the line 7-7 in the direction indicated by the arrows thereon.

Figure 8 is an enlarged portion of Figure 7 taken in circle 8 thereon to show the detail of the adjustable fasteners extending between the base bottom and the interconnected spring bottom support.

V. DESCRIPTION OF THE PREFERRED EMBODIMENT

My stool generally comprises base **10** movably supporting upwardly extending seat structure **11**, with spring structure **12** communicating therebetween and support structure **13** carried by the base externally thereof.

Base **10** provides a rigid peripherally defined unitary conic body having right cylindrical conic side surface **14**, perpendicular truncating top **15** and somewhat radially larger lowermost base ring **16**, all of substantially equal limited thickness to define medial base chamber **17**. Annular circumfrencially extending support rings **18** are carried in axially spaced relationship on conic side surface **14** to provide additional strength and rigidity for the base structure. Three fastener holes **19** are defined in top **15** in spaced symmetrical array about the conic axis of the base to accept fasteners for a seat support stop disk. Three similarly arrayed seat support shaft holes **20** are defined through the truncated top surface **15** between and radially outwardly from the three fastener holes **19** to accept seat support shafts.

Medial base chamber **17** is enclosed in its lower part by circular bottom disk **21**, which preferably is supported with its bottom surface coplanar with the bottom surface of base ring **16** by annular support **22** that fits radially inwardly of the inner surface of base ring **16** and between the lower surface of shoulder **23**,

defined at the intersection of conic side surface **14** with base ring **16**, and the upper surface of the bottom disk **21**. The bottom disk **21** is positionally maintained on the base **10** by Z-shaped wheel brackets **24** having upper horizontal radially outwardly extending arms **24a** communicating with medial vertical bodies **24b** extending adjacent to the outer surface of base ring **16** to lower horizontal arms **24c** extending radially inwardly adjacent the lower surface of bottom disk **21**.

Lower wheel bracket arm **24c** is fastened to the adjacent portion of the bottom disk **21** by fasteners **25** and the medial body **24b** is fastened to the adjacent portion of base ring **16** by fasteners **26** extending therebetween. The upper horizontal arms **24a** of each wheel support bracket carry depending caster wheels **27** so sized and positioned that the lower surfaces of the caster wheels **27** depend slightly below the plane of the lower surface of base ring **16** and bottom disk **21**. This allows the wheels **27** to provide locomotion over an underlying supporting surface when the stool is in relaxed unloaded mode, but also allows the bracket **24** to resiliently deform when the stool is in its loaded mode to provide stationary or positionally maintaining support on an underlying supporting surface.

The truncating top surface **15** of base **10** carries seat support stop disk **28** spacedly thereabove. The stop disk **28** is supported on three tubular pillars **29** positioned above fastener holes **19** and carrying

fasteners **30** communicating from the stop disk through the channels of pillars **29** and through truncating top **15** for fastening on the under surface of the top to positionally maintain the seat support stop disk **28**. The seat stop disk **28** defines elongate fastener slot **31** in its medial portion to receive a seat fastener. The seat stop disk **28** is spaced above the top **15** of the base only sufficiently to allow operation of a seat fastening lever between the stop disk **28** and upper surface of top **15**.

Seat structure **11** provides rigid seat disk **32** carrying plural depending seat support shafts **33**, in the instance illustrated comprising three elongate tubes arrayed symmetrically about the disk axis in such position as to be carried in seat support shaft holes **20** defined in top **15** of the base **10**. The lower ends of seat support shafts **33** are carried in holes **34** defined in the upper surface of disk-like upper spring plate **35** carried in medial base chamber **17**. The seat support shafts **33** and seat support shaft holes **20** are so configured that the shafts **33** may readily move vertically through the support shaft holes **20**. The length of the support shafts **33** is somewhat less than the distance between bottom disk **21** and seat support top disk **28** and, in the instance illustrated about one half of that distance. The seat disk **32**, and especially its upper surface, may be covered with external padding (not shown) to provide greater user comfort, according

to principles and practices heretofore known in the chair and stool arts.

Seat disk **32** carries depending fastener **36**, in the instance illustrated comprising screw shaft **36a** having fastening ring **36b** in its lower end portion. The fastener **36** is carried in a medial position in the support disk and so oriented that ring **36b** will pass vertically through fastener slot **31** defined in seat support stop disk **28** when the seat support disk **32** is sufficiently depressed. Fastening lever **37** is pivotally mounted on the undersurface of the seat support stop disk **28** by fastener **40** for pivotal motion in the space between top **15** of the base and the seat stop disk **28** spacedly thereabove. As seen in Figure 5, fastening lever **37** is an elongate structure comprising body **38** having upstanding finger tab **39** at its radially outer end and defining hole **40a** for fastener **40** in its radially inner end with fastening finger **41** in its medial portion angularly outward to engage within fastener ring **36b**. The fastening lever **37** is so configured and sized that it may selectively pivot fastening finger **41** to pass within fastener ring **36a** and move outwardly from that ring when extending beneath the seat stop disk **28** to provide releasable fastening of seat support disk **32** in a downward position relative to base **10**.

Spring structure **12** provides compression spring **42** supported on spring bottom support disk **49** and extending

upwardly to the lower surface of upper spring plate **35**. The compression spring **42** illustrated is of a cylindrical even wound type, but if desired for particular biasing results of the seat support disk **32**, the spring **42** may assume various other known configurations such as conical or non-uniformly spaced spiral configuration.

The lower end of compression spring **42** may be supported directly on the upper surface of bottom disk **21**, but preferably though not necessarily, it is supported on spring bottom support disk **49** to allow adjustment of the compression in the compression spring **42** when it is in a null state without any live load on seat disk **32**. As seen in Figures 6-8 the spring bottom support disk **49** is supported spacedly above the bottom disk **21** by four bolt type fasteners **50** with threaded shafts extending upwardly through quadrantally arrayed holes **51** defined in the bottom disk **21**. Fasteners **50** are maintained in holes **51** by nuts **52** and extend spacedly thereabove. Washers (not shown) may be carried on both sides of nuts **52** to aid the operation of fasteners **50**. The spring bottom support disk **49** carries four support nuts **54** quadrentally positioned therein for threaded engagement on upwardly projecting threaded portions of fasteners **50**. The support nuts **54** are of an internal type contained within holes **53** defined in spring bottom support disk **49** and have radially projecting fins (not shown) to aid positional

maintenance and to prevent rotation in the holes carrying them. When the support nuts **54** carried in the spring bottom support disk **49** are engaged on fasteners **50** the fasteners **50** may be rotated by manipulating their heads from the outer surface of bottom disk **21** to move the spring bottom support disk **49** relatively to the bottom disk **21** and thusly adjustably regulate the distance between upper spring plate **35** and the spring bottom support disk **49** to determine the null bias in compression spring **42** within limits, depending upon the nature of the compression spring.

Preferably to maintain alignment of compression spring **42** within base chamber **17**, but not necessarily, disk-like spring support **43** may be carried in a medial position on the upper surface of spring bottom support disk **49** to fit within the lower portion of the compression spring **42**. Depending disk-like protuberance **44** also may be provided on the lower surface of upper spring plate **35** to fit within the upper portion of the compression spring **42** for similar alignment purpose. In general however in the preferred embodiment illustrated, the compression spring **42** is large enough that it is sufficiently positionally maintained by the inner surface of base **10** that defines the base chamber **17**.

Support structure **13** provides two similar diametrically opposed upstanding support loops **45** formed of rigid elongate channel elements and interconnected by arcuate back support **46**, all carried by base **10** to

extend about the base periphery to aid a user in entering on and exiting from the stool. Each loop **45** is structurally carried by similar fastening plates **47** fastened on the under surface of bottom disk **21** of the base **10** by fasteners **48** communicating therebetween. Back support **46** is structurally interconnected between the adjacent rearward portions of each opposed support loop **45** and to the conic side surface 14 by fastener **55** to provide greater strength and rigidity for the entire support structure. The support loops **45** extend upwardly a spaced distance above seat disk **32** when in its upwardly biased mode. My stool is useable without this support structure, though the support structure does add substantial ease and convenience to stool use.

Having described the structure of my stool, its use and function may be understood.

For use a stool constructed according to the foregoing specification is positioned on a supporting surface in a location for use. A user grasps one or both support loops **45** in the upper portion and uses those structures for guidance and partial support to aid in entering upon seat disk **32**. As the user is seated the seat disk **32** moves downwardly against the bias spring responsive to the user's weight. This seat disk motion responsively compresses spring **12** by moving upper spring plate **35** downwardly upon the upper portion of the compression spring **42** to create compressive force in the spring. The downward motion of the seat disk **32** will

be stopped when the lowermost portion of fastener **36** contacts the upper surface of top **15** of the base **10**, if the seated weight of the user is sufficient to depress the seat disk **32** this far.

As the user's weight becomes supported by compression spring **42** and bottom disk **21**, the downward force ultimately will be supported by caster wheels **27** resting on the underlying supportative surface. As this occurs, the upper arm **24a** of wheel bracket **24**, which has some resilient deformability, will move upwardly until the lower surfaces of base ring **16** and bottom disk **21** of the base 10 are supported on the underlying supportative surface to provide positionally maintainable support of the stool while the user remains seated on the stool. The stool in this condition then may be used as a support while the user remains seated.

If the user desires that seat disk **32** should not move upwardly above its lowermost position to relieve the effects of spring bias for more comfortable usage, fastening lever **37** may be operated to pivot fastening finger **41** into the orifice defined by ring **36b** of fastener **36** and the seat will be positionally maintained by the fastening lever.

Normally spring **12** will be configured as known in the compression spring art to move downwardly to bring support disk **32** to its lowermost position, with fastener **36** resting substantially on truncating top surface **15** of the base **10** when a person of average weight is seated on

the seat disk **32**. If the stool is to be used by a person substantially above or below an average weight, the compression springs **42** of the stool may be appropriately configured, pursuant to known compression spring art, to be positioned in the same downwardmost position when a person of the particular variant weight involved is seated on the seat disk **32**. The stool however, is equally useable by a person of any weight without the fastener **36** being in fastening contact with the finger **41** of the fastening lever **37**.

When a person seated on the stool is desirous of exiting from the stool, fastening lever **37** is released, if it is fastened, and the user moves to get up from the seat in the habitually familiar fashion, with or without hand support on support loops **45**. As this occurs the kinetic energy stored in spring **12** by reason of its compression will be released as the user moves upwardly from the stool and this kinetic energy will be transferred into a force tending to move seat **32** upwardly to make it easier for the user to get up from the stool than would be possible without the release of the spring's kinetic energy. As the user removes himself from the seat disk **32** and from any substantial support on loops **45**, the retentant memory in the upper limbs **24a** of wheel brackets **24** will cause those brackets to move downwardly to their initial unstressed position to responsively move caster wheels **27** downwardly to again support the stool on an underlying supportative surface

for motion of the stool thereover.

It is to be noted from the motions described for my stool in the seating and unseating processes that seat disk **32** will move substantially vertically upward and will not tip or tilt materially during its upward motion or thereafter. Any tipping or tilting motion, especially in a low stool such as the instant one, may cause a person exiting from a seated posture on the seat disk to lose balance and possibly fall in the process of exiting from the stool.

It is further to be noted that my stool may be used to perform its seating and unseating functions without use of either castor wheels or support structure **13**.

The foregoing description of my stool is necessarily of a detailed nature so that a specific embodiment of its best known mode might be set forth as required, but it is to be understood that various modifications of detail, rearrangement and multiplication of parts might be resorted to without departing from its spirit, essence or scope.

Having thusly described my invention, what I desire to protect by Letters Patent, and

What I claim is: